CLAIMS

We Claim:

1. A method of performing a frequency correction of a radio module, said method comprising the steps of:

a) sampling frequency data a first time to estimate a first frequency error;

b) applying a first reference frequency to a radio transceiver of said radio module to compensate for said first frequency error, wherein said radio transceiver uses said first reference frequency along with a frequency output by an oscillator to tune said radio transceiver;

c) if said first frequency error is greater than a pre-determined amount, performing a large shift frequency correction, said step c) comprising the steps of:

c1) sampling frequency data a second time to estimate a second frequency error after said first frequency correction; and

c2) if said first frequency correction was within pre-determined parameters, applying a second reference frequency to said radio transceiver to compensate for said second frequency error, wherein said second reference frequency compensates for said first and said second frequency errors.

2. A method as described in Claim 1 wherein said step c) further comprises the step of:

c3) if said first frequency correction was not within said pre-determined parameters, restoring an original reference frequency.

3. A method as described in Claim 1 wherein said step c) further comprises the steps of:

c3) determining if said radio transceiver receives data validly after said second frequency correction, wherein whether valid data is received is determined according to pre-determined criteria;

c4) if said data is valid, storing said second reference frequency in memory; and

c5) if said data is not valid, restoring said original reference frequency.

4. A method as described in Claim 3 wherein said step c4) comprises the step of updating a reference frequency stored in non-volatile memory.

5. A method as described in Claim 3 wherein said step c5) comprises the step of restoring said original reference frequency by transferring said original reference frequency to a processor in said radio module.

6. A method as described in Claim 1 further comprising the steps of:

d) if said first frequency error is less than a pre-determined amount, updating a net total of all frequency errors since the last time a reference frequency stored in memory was updated; and

e) if said net total is greater than a pre-determined amount, storing in memory a new reference frequency based on said net total and the previous reference frequency stored in memory.

7. A method as described in Claim 1 wherein said step a) comprises the steps of:

a1) sampling said frequency data a plurality of times during a quiescent period; and

a2) applying a median filter to said frequency data.

8. A method as described in Claim 1 wherein said step b) comprises the step of:

b1) transferring said first reference frequency to a processor in said radio module.

9. A method as described in Claim 1 wherein said step c2) comprises the step of determining if said second frequency error is less than a pre-determined amount.

10. A method as described in Claim 1 wherein said step c2) comprises the step of determining if the second frequency error is less than a pre-determined percent of said first frequency error.

11. A method of performing a frequency correction of a radio module, said method comprising the steps of:

a) sampling frequency data a first time to estimate a first frequency correction needed;

b) applying a first reference frequency to a radio transceiver in said radio module to provide said first frequency correction, said first reference frequency based on an original reference frequency and said first frequency correction needed; and

c) if said first frequency correction is greater than a pre-determined amount, performing a large shift frequency correction, said step c) comprising the steps of:

c1) sampling frequency data a second time to estimate a second frequency correction needed after said first frequency correction was performed;

c2) applying a second reference frequency to said radio transceiver to provide said second frequency correction, wherein said first reference frequency is replaced with said second reference frequency, said second reference based on said first reference frequency and said second frequency correction needed; and

c3) assessing the ability of said radio transceiver to receive data after said second frequency correction.

12. A method as described in Claim 11 wherein said step c3) comprises the step of determining if packet data received by said radio transceiver is valid.

13. A method as described as in Claim 12 further comprising the steps of:

d) if said packet data is not valid, restoring said original reference frequency; and

e) if said packet data is valid, storing said second reference frequency in memory, wherein said second reference frequency is used by said radio

transceiver along with a frequency output by an oscillator to tune said radio transceiver.

14. A method as described in Claim 11 wherein said step c3) comprises the step of determining if said radio transceiver is able to receive data within a pre-determined error rate.

15. A method as described in Claim 11 wherein said step a) comprises the steps of:

a1) sampling said frequency data a plurality times; and

a2) filtering said frequency data, wherein the probability that said frequency data is invalid is substantially eliminated.

16. A method as described in Claim 15 wherein said step a2) comprises the step of applying said frequency data to a median filter, wherein the median frequency data sample is used to determine the first frequency correction needed.

17. A method as described in Claim 11 further comprising the steps of:

d) if said first frequency correction is less than a pre-determined amount, updating a net total of all frequency corrections made since the last time a reference frequency stored in memory was updated; and

e) if said net total is greater than a pre-determined amount, replacing said stored reference frequency with a value based on said net total of all frequency corrections and said stored reference frequency.

18. A method as described in Claim 11 wherein said step a) comprises the step of:

a1) sampling said frequency data during a quiescent period.

19. A method as described in Claim 11 wherein said step a) comprises the step of:

a1) sampling said frequency data while packet data is being received.

20. A method as described in Claim 11 wherein said step c3) comprises the steps of:

i) receiving quality metrics from said radio transceiver; and

ii) determining if said quality metrics have improved as a result of said second frequency correction.

21. In a computer system having a processor coupled to a bus, a computer readable medium coupled to said bus and having stored therein a computer program that when executed by said processor causes said computer system to implement a method of performing a frequency correction of a communication device, said method comprising the steps of:

a) sampling frequency data a first time, wherein said sampling comprises a plurality of frequency samples;

b) filtering said frequency data to estimate a first frequency error;

c) if said first frequency error is larger than a pre-determined value, executing a large shift frequency correction; and

d) if said first frequency error is smaller than a pre-determined value, executing a small shift frequency correction.

22. The computer readable medium of Claim 21, wherein said step c) of said method comprises the steps of:

c1) applying a first reference frequency to a radio transceiver in said communication device to compensate for said first frequency error, wherein said radio transceiver uses said first reference frequency along with a frequency output by an oscillator to tune said radio transceiver;

c2) sampling frequency data a second time to estimate a second frequency error after said first frequency correction; and

c3) determining if said first frequency correction was satisfactory by determining if said second frequency error is less than a pre-determined value.

23. The computer readable medium of Claim 22, wherein said step c) of said method further comprises the steps of:

c4) if said first frequency correction was unsatisfactory, restoring an original reference frequency; and

c5) if said first frequency correction was satisfactory, applying a second reference frequency to said radio transceiver to compensate for said second frequency error, wherein said second reference frequency compensates for said first and said second frequency errors.

24. The computer readable medium of Claim 23, wherein said step c) of said method further comprises the steps of:

c6) determining if said radio transceiver receives data validly after said second frequency correction, wherein whether valid data is received is determined according to pre-determined criteria;

c7) if said data is valid, updating a reference frequency stored in a memory with said second reference frequency; and

c8) if said data is not valid, restoring said original reference frequency.

25. The computer readable medium of Claim 22 wherein said step c) of said method further comprises the steps of:

c4) if the previous frequency correction was unsatisfactory, determining a new reference frequency based on said previous reference frequency, wherein the frequency is corrected by an amount which is a function of the last frequency correction;

c5) applying said new reference frequency to said radio transceiver to provide said new frequency correction;

c6) sampling frequency data to estimate a frequency error after said new frequency correction; and

c7) repeating said step c4 through step c6) until said frequency correction is satisfactory.

26. The computer readable medium of Claim 25 wherein said step c4) of said method comprises the step of performing a binary search.

27. The computer readable medium of Claim 25 wherein said step c4) of said method comprises the step of performing a step-by-step search.

28. The computer readable medium of Claim 21, wherein said step d) of said method comprises the steps of:

d1) applying a first reference frequency to a radio transceiver in said communication device to compensate for said first frequency error, wherein said radio transceiver uses said first reference frequency along with a frequency output by an oscillator to tune said radio transceiver;

d2) updating a net total of all frequency errors since the last time a reference frequency stored in memory was updated; and

d3) if said net total is greater than a pre-determined amount, storing a new reference frequency based on said net total and the previous reference frequency.